SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*THE DOVER MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.**

IT appears from the accounts in the foreign journals and from communications sent us that the recent meeting of the Association maintained the standard set by its long history. The address by the President already published in this JOURNAL, was a model of what such an address should be, and the addresses of the presidents of the Sections were thoroughly scientific and yet, at the same time, intelligible to all. We give below some account of the more important papers presented before the different sections.

The special event of the meeting was the interchange of visits between the members of the British and French Associations. About 280 members of the French Association came over from Bologne on the Saturday of the meeting, and were entertained both socially and by placing on the programs several addresses and papers of special interest. On the following Wednesday about 100 members of the French Association again crossed the Channel and met members of the British Association at Canterbury. The visits were returned on Thursday by about 250 members of the British Association. On these different oc-

*Based on reports in the London *Times* and in *Nature*.

casions there were numerous addresses and expressions of good-will.

There was in all an attendance of 1,403 at the Dover meeting, but when it is remembered that more than half were associates and new annual members, it will be seen that the meeting was no larger than those of the American Association, when held at places equally accessible to as many members. The British Association, however, greatly exceeds our own in its ability to make grants for scientific research. In addition to a special appropriation of £1,000 for the British Antarctic expedition, grants amounting to £1,115 were made as follows:

	£
Mathematics.	
Rayleigh, Lord—Electrical Standards (£300 in hand)	25
Judd, Prof. J. W.—Seismological Observations (£9 5s. 4d. in hand)	60
FitzGerald, Prof. G. F.—Radiation in a Magnetic Field	25
Rücker, Prof. A. W.—Magnetic Force on board Ship	10
Callendar, Prof. H. L.—Meteorological Observatory, Montreal	20
Kelvin, Lord—Tables of Mathematical Functions	75
Chemistry.	
Hartley, Prof. W. N.—Relation between Absorption Spectra and Constitution of Organic Bodies	30
Roscoe, Sir H. E.—Wave-length Tables	5
Reynolds, Prof. J. E.—Electrolytic Quantitative Analysis	5
Miers, Prof. H. A.—Isomorphous Sulphonic Derivatives of Benzene	20
Neville, Mr. F. H.—The Nature of Alloys	30
Geology.	
Hull, Prof. E.—Erratic Blocks (£6 in hand)	
Geikie, Prof. J.—Photographs of Geological Interest	10
Dawkins, Prof. W. B.—Remains of Elk in the Isle of Man	5
Dawson, Sir J. W.—Pleistocene Fauna and Flora in Canada	10
Lloyd-Morgan, Prof. C.—Ossiferous Caves at Uphill (£8 in hand)	10
Watts, Prof. W. W.—Movements of Underground Waters of Craven	40
Scharff, Dr.—Exploration of Irish Caves	20
Zoology.	
Herdman, Prof. W. A.—Table at the Zoological Station, Naples	100
Bourne, Mr. G. C.—Table at the Biological Laboratory, Plymouth	20
Woodward, Dr. H.—Index Generum et Specierum Animalium	50
Newton, Prof.—Migration of Birds	15
Lankester, Prof. E. Ray.—Plankton and Physical Conditions of the English Channel	40
Newton, Prof.—Zoology of the Sandwich Islands	100
Sedgwick, Mr. A.—Coral Reefs of the Indian Region	30
Geography.	
Murray, Sir John—Physical and Chemical Constants of Sea Water	100
Economic Science and Statistics.	
Price, Mr. L. L.—Future Dealings in Raw Produce	5
Sedgwick, Prof. H.—State Monopolies in other Countries (£13 13s. 6d. in hand)	
Mechanical Science.	
Preece, Sir W. H.—Small Screw Gauge (£17 1s. 2d. in hand)	
Anthropology.	
Evans, Mr. A. J.—Silchester Excavation	10
Penhallow, Prof. D. P.—Ethnological Survey of Canada	50
Tylor, Prof. E. B.—New Edition of 'Anthropological Notes and Queries'	40
Garson, Dr. J. G.—Age of Stone Circles (balance in hand)	
Read, Mr. C. H.—Photographs of Anthropological Interest	10
Brabrook, Mr. E. W.—Mental and Physical Condition of Children	5
Read, Mr. C. H.—Ethnography of the Malay Peninsula	25
Physiology.	
Schäfer, Prof. E. A.—Physiological Effects of Peptone	20
Schäfer, Prof. E. A.—Comparative Histology of Suprarenal Capsules	20
Gotch, Prof. F.—Comparative Histology of Cerebral Cortex	5
Gotch, Prof. F.—Electrical Changes in Mammalian Nerves	20
Starling, Dr.—Vascular Supply of Secreting Glands	10
Botany.	
Darwin, Mr. F.—Assimilation in Plants (£6 6s. 8d. in hand)	

Farmer, Prof. J. B.—Fertilization in Phæophyceæ 20

Corresponding Societies.

Meldola, Prof. R.—Preparation of Report..... 20

The report of the Council adopted by the general committee, made a number of important reports and recommendations. Arrangements have been made for the establishment of a Bureau of Ethnology in coöperation with the British Museum. The Government of Cape Colony is not able to make immediate provision for a magnetic observatory. Plans are being arranged for a central building for seismological observations and to collect statistics of the physical and mental characteristics of the races throughout the Empire, especially in India. It was decided not to reprint the collected reports on the Northwestern Tribes of Canada in a single volume. The British Admiralty was requested to secure systematic observations on the erosion of the sea coast.

We hope to be able to publish special accounts of the proceedings of some of the sections, but it may be convenient for the reader to have a general survey of the more important papers presented during the meeting. In the Mathematica land Physical Section the interest created by the address of the president, Professor Poynting, already published in SCIENCE, was sustained throughout the meeting by papers describing the results of important work. The much-discussed question of color-vision was raised once more by the paper of Mr. G. J. Burch on 'The Spectroscopical Examination of Contrast Phenomena.' His investigations lead him to support the Helmholtz theory, but also to suppose that a fourth primary sensation should be admitted—namely, blue. During the year the committee on electrolysis and electrochemistry continued the work begun last year and furnished a report of progress.

On the occasion of the visit of members of the French Association, Professor J. J. Thomson gave a masterly exposition of the various lines of research by which it has been concluded that the atom is not the smallest existing quantity of matter. Electro-chemical phenomena teach us to associate a definite amount of electricity with each atom of matter; but these recent researches indicate that under certain circumstances a much larger quantity of negative electricity may be conveyed by the atom, or else that the negative electrical charge resides on a small detachable portion of the 'atom,' which alone is concerned in the experiments. The positive charge seems to be distributed over the whole mass of the atom.

The exploration of the higher regions of our atmosphere, by means of kites bearing meteorological instruments, was reported by Mr. A. L. Rotch, of the Blue Hill Observatory, and supplied convincing proof of its usefulness in weather forecasting and in climatology. Professor Darwin called attention to the fact that such work is unduly negelcted in Great Britain, because there is no Government meteorological observatory. Another interesting paper from America was presented by Dr. L. A. Bauer, who described the work of the newly-organized division of the U. S. Coast and Geodetic Survey for the study of terrestrial magnetism in the United States. A discussion on thermometry which was introduced by Professor Callendar, will, it is hoped, lead to the adoption of a standard platinum thermometer. The matter is to be fully discussed by the Committee on Electric Standards, which has done good work in the past in connection with electrical measurement.

In the Chemical Section particular prominence was given to the discussion of subjects of a general character. Undoubted good resulted from the consideration of the best means to organize the study of atomic weight determinations, whilst the joint dis-

cussion with Section K (Botany) on symbiotic fermentation, in which several of the French visitors took part, was of much interest. Professor Marshall Ward, in opening the discussion, after considering the conditions under which symbiosis existed both in the vegetable and animal kingdoms, illustrating his views with such examples as that of the dual organism of lichens in which alga and fungus were the contributory organisms, passed to the more special subject of symbiotic fermentation. In symbiotic fermentations the one organism, such as a mould, appeared to prepare the way for the action of a subsequent agent, such as yeast; and the preparation of Japanese saké, or rice wine, is a typical example of this dual effect. The discussion which followed it is hoped has led to a more exact recognition of the divisions and relations of symbiotic changes which may serve to develop the study of the subject.

Professor Dewar's important discoveries relating to the solidification of hydrogen will be noticed subsequently. Colonel Waterhouse contributed a note on a remarkable result he has observed on the exposure of metallic silver to light; a visible image results on the exposed plate after prolonged exposure, but the effect may be got in a very much shorter space of time by the development of the latent image that is produced. The industrial application of what was probably a similar action was referred to by Sir W. Roberts-Austen. Although the papers on organic chemistry were of a technical character, the discussions, reports, and individual contributions in this branch of the science aroused much interest, and special importance is to be attached to a paper by Mr. W. J. Pope, on the influence of solvents upon the optical activity of organic compounds.

The chemists present at Dover will always look back upon the meeting with a special appreciation of the able address delivered by the President of the Section, Dr. Horace T. Brown. The subject of the fixation of carbon by plants is a common meeting ground for the chemist, physicist and biologist. After reference to the accustomed view that the higher plants derive the whole of the carbon which goes to build up their tissues from the carbonic acid of the atmosphere, Dr. Brown reviewed the work that has been done to show that extra-atmospheric sources of carbon may exist, and detailed his own experiments on the intake of carbon dioxide by plants, showing that this is directly proportional to the tension of the gas.

Sir Archibald Geike's presidential address before the Section of Geology which was given on the occasion of the visit of the French Association is printed below. The list of papers in geology was, as usual, a full one, so that, especially during the earlier days of the meeting, the time for discussion was limited. The subjects dealt with ranged over the whole of the wide field included in geological science, without any particular division being notably prominent. In stratigraphical as well as in economic geology the most important papers were those dealing with the coalfields, and from their additional local interest those of Mr. R. Etheridge, F.R.S., and Professor W. Boyd Dawkins, attracted especial attention. Mr. Etheridge treated the relations existing between the Franco-Belgian coalfield and those of Southwestern Britain, with the object of proving that the recent discoveries in Kent indicated the existence of a chain of concealed coal-basins connecting the two regions. Professor Boyd Dawkins, while pursuing the same general argument and recapitulating the history of the discoveries in Kent, gave a brief description of the borings at present in progress under his superintendence at Ropersole, Ottinge, Hothfield, Old Soar, near Tonbridge, and Penshurst. At pres-

ent only the first of these has penetrated the secondary rocks, reaching coal measures at a depth of 1,580 feet below the surface; the others have reached various horizons in the lower Cretaceous and Jurassic strata, which are found to thicken rapidly southward. Professor Boyd Dawkins concluded from the evidence of these borings that the southern boundary of the concealed coalfield in the eastern part of its course ranges nearly under the scarp of the South Downs, and that to the south of this the paleozoic floor is probably composed of rocks older than the coal measures.

The concealed coal fields of another part of England—viz., North Staffordshire—were discussed by Mr. Walcot Gibson, of the Geological Survey, whose recent investigations have shown that the so-called Permian rocks which overlie the productive measures at the margin of this field should be considered as part of the carboniferous system, since they are conformable to the upper coal-measures and contain a coal-measure flora. By working out the details of these rocks, Mr. Gibson has been able to show that on the northwestern side of the Staffordshire anticline the productive coal-measures are likely to occur within reach further west than might have been expected, thus increasing considerably the workable area of this coal field. It is interesting to find that these results have been attained by the minute study of strata which in themselves do not possess any direct economic value. Another stratigraphical paper with a practical application was that of Professor Boyd Dawkins on the geological conditions of the proposed channel tunnel. The reading of this paper was followed by a brisk discussion, in which it was generally acknowledged that, apart from political reasons, there was not likely to be any serious difficulty in driving the tunnel through the lower beds of the chalk from England to France. In the division of structural geology, Mrs. M. M. Gordon, D.Sc., contributed an analysis of the principles which underlie the complicated phenomena of folding to be found in the mountainous regions of the earth's crust.

As befitted the place of meeting, coast erosion received much attention from the section, three papers on this subject being read. Of these the most valuable was that of Mr. W. Whitaker, F.R.S., who summarized a large number of reports made by the coastguards all around the Kingdom as the result of circulars of inquiry sent out by the council of the Association with the sanction of the government authorities. This research promises eventually to yield highly important results in regard to the rate of destruction of our coasts by marine erosion.

In the department of paleontology, with the exception of one or two reports of committees, the papers were unimportant, while petrological science was represented mainly by a highly suggestive contribution by Professor A. Renard, of Ghent, on chondritic meteorites, in which it was pointed out that the rock structure of these visitants to our planet indicated that the parent mass had been subjected to the action of metamorphism in a manner similar to that of some of the rocks of the earth's crust.

A paper brought forward by Professor P. F. Kendall gave the result of some recent researches into the course of underground streams in the limestone district of Northwest Yorkshire; by the methods adopted the underground course taken by the principal sources of the river Aire have been more or less definitely traced.

The address of the President of Section D (Mr. Adam Sedgwick, F.R. S.) reviewed the facts of variation in their relation to reproduction and sex. Mr. Sedgwick contended that the variability of organisms must have been progressively greater the further we go back from the present time—

a conclusion of importance, because it enables the biologist to bring his requirements as to the time of evolutionary change within the limits granted by the physicist.

The memorable features of the Dover meeting, so far as the zoological communications were concerned, were undoubtedly Mr. J. J. Lister's account of the newly-discovered calcareous sponge *Astrosclera* and Mr. Smith Woodward's exhibition of fossil and recent remains of animals from Patagonia. The sponge, whose structure was explained by Mr. Lister, was exhibited at the International Zoological Congress at Cambridge last year, and completely puzzled all who examined it. It was brought home by Dr. Willey, along with other material, from the Loyalty Islands in the Western Pacific. During the past year Mr. Lister has subjected the four specimens to a minute and thorough examination. He finds their structure to be undoubtedly that of a calcareous sponge, differing, however, in regard to its skeleton, canal system, and other points from all other sponges extant, but resembling to a surprising extent the fossil group of *Pharetrones*, which are found in strata ranging from the Devonian to the chalk.

Mr. Smith Woodward's exhibition, on behalf of Dr. Moreno, of some newly-discovered remains of the ground-sloth *Neomylodon*, hitherto supposed to be extinct, was received by the section with great interest. The skull exhibited was still invested with pieces of flesh and cartilage, which bore witness to the freshness of its condition. A skull of the great extinct turtle *Miolania* from Patagonia was also examined with much interest by zoologists, on account of the close resemblance which it bears to the specimens already known from Queensland and Lord Howe's Island. Mr. Graham Kerr's success in bringing home a complete series of stages in the development of the lung-fish *Lepidosiren*, gained for him the hearty congratulations of the Section. Mr. Garstang's account of the work already accomplished by the committee for periodically surveying the Plankton and physical conditions of the English Channel, promised well for the satisfactory completion of a most important undertaking, and the discussion on marine fish culture was of a thoroughly practical character.

One has to go back to the earlier years of the Association to find so excellent a program, from the scientific point of view, as that presented by the Geographical Section at Dover. The papers on scientific geography were many and the travel papers few, and such of the latter as were presented were up to a high standard. The address of the President, Sir John Murray, gave an admirably clear *résumé* of the chief results which have been attained in the investigation of the oceans during the last 30 years or so. The concluding portion of his address dealt with the subject of Antarctic exploration, with special reference to the proposed National Antarctic Expedition, and the greater part of the following day was devoted to a discussion of the same subject. The President's remarks and the statements brought forward in the discussion are generally regarded as expressing the views of scientific men as to what ought to be the program of the British expedition. There can be no doubt, from what took place in the Geographical Section, that the feeling among scientific geographers is that the expedition should not be a mere naval adventure, but that, as far as the funds available allow, the expedition should be so organized as to secure the largest possible gain to all departments of science interested in the Antarctic. It is to be hoped that Sir John Murray's appeal for an additional £50,000 will meet with a prompt response, as it will then be possible to send two ships, and to render the program of the enterprise complete all

round to the satisfaction of all concerned in its organization. All who heard Admiral Makaroff's paper on the wonderful work accomplished by his ice-breaker would wish, if it were possible, to send such a ship to the Antarctic, and with an available fund of £150,000 this might be possible. Naturally, with Sir John Murray in the chair, oceanography and limnology were prominent, though Sir John seemed to think that Dr. Mill's attempt to formulate a nomenclature of the bed of the ocean was somewhat premature. Notwithstanding the criticism of Mr. Crook, Sir John Farquharson's account of the last twelve years' work of the Ordnance Survey proved that the British Survey maps will stand comparison with those produced in other countries. Sir John Farquharson was unable to exhibit the magnificent series of maps which he had brought with him owing to lack of space. The papers by Mr. and Mrs. Rickmers on their journey in Central Asia and by Captain Wellby, on his remarkable journey to Southern Abyssinia and Lake Rudolf, and thence northwest to Khartum, were excellent; while Dr. Haddon's notes on his expedition to New Guinea and Borneo were a good illustration of what is meant by 'Anthropogeography.'

In the section of Economics and Statistics, the president, Mr. Henry Higgs, abstained from reviewing the progress of economic theory, and his thoughful plea for a detailed study of the actual consumption of wealth and a consideration of the ways in which it may be improved has excited considerable attention. Whether his advice will be taken remains to be seen, but, if the proceedings of the Section afford material for judging, professed economists have ceased to interest themselves in economic theory. They were strongly represented at the meeting by Professors Edgeworth, Smart, and Flux, Messrs. Cannan and Bowley, Dr. J. H. Hollander, and others, but not one contribution to economic theory was offered by any of them. The subject which now seems to draw the largest audience and the most animated discussion is what may be called municipal economics; and in the annual discussion of subjects which come under this head the Section is probably doing its most useful work. The subject of the measurement of wages and retail prices was dealt with in several papers.

Meeting under the presidency of Sir William White, chief constructor to the British Navy, it was natural that marine engineering should be the most prominent feature of the work of Section G, at Dover. In his address, the president, after dealing with the great progress of the past 60 years, not only in size of ships, but in speed and increased engine power, discussed the probable lines of advance in future, and by the help of some convincing figures showed how serious and practically insuperable were the difficulties ahead of us in the matter of greatly increased speeds for big liners and cruisers, and, in fact, for large ships generally. A paper by the Hon. C. A. Parsons, F.R.S., on the application of his now well-known steam turbines to the driving of fast passenger steamers, both for cross-Channel and for the Atlantic service, came as a convincing supplement to this portion of the president's address. In the discussion the author was able to state that the preliminary trials had thoroughly confirmed his anticipations of success. In view of the wild statements and of the misleading deductions so often made from the high speeds now attained in destroyers, it seems well to point out that Mr. Parsons, in his proposed liner of 600 feet length and 18,000 tons displacement, does not propose a greater speed than 26 knots, and to obtain this he would need, even with all the advantages he claims for his steam turbines in reduction of weight, etc., no less than 38,000-horse power, or over two-horse power

per ton of displacement; in the cross-Channel boat he proposed 30 knots. The improvement in the time of transit through the Suez Canal, due both to the widening and deepening of the original canal and to the use of the electric light for night passages, were the striking facts of Sir Charles Hartley's valuable description of the engineering features of the canal.

In the Anthropological Section, Mr. C. H. Read's address developed the idea first proposed by him at the Liverpool meeting of an Imperial bureau of ethnology. The scheme has been accepted in principle by the Government, and the administrators of native races have now the highest official encouragement to furnish reports and observations to the central institution. The bureau will stand in relation to the Ethnographical Department of the British Museum, but the Museum cannot maintain the bureau from its own resources; still less can it provide the teaching organization which Mr. Read regards as an essential part of this scheme. The solution which he proposes is to establish the bureau in a part of the Imperial Institute; to transfer the Ethnographical Department thither into the close neighborhood of the Indian and Art Museums; and to look to the University of London, established under the same roof, for a professor and a school of anthropology. Dr. Haddon and his colleagues described the Cambridge expedition to Torres Straits, of which we hope to give later some account. The papers of Dr. Garson, Mr. MacIver, and Professor Macalister illustrated in different ways the growing demand for real accuracy in anthropometry, the growing scepticism of the possibility of distinguishing races by mere linear measurements of the bones, and the stimulus which these uncertainties have given to better methods of obtaining and tabulating the data. The practical importance of this side of anthropology came out well in the discussion of the merits of measurements and of finger prints in the identification of criminals in India. Dr. Rivers's method of genealogical census and Professor Petrie's system of accurate sequence dating for antiquities are also worthy of separate mention.

The Section of Physiology was that to which the President of the Association himself specially belonged, and this may account for the numerous papers and reports which were presented at the Dover meeting. They proved how much need there was for the institution of such a Section. The papers presented were of scientific importance, but were in most cases too technical for abstracts.

In the Botanical Section the meetings were very successful, and some very interesting papers were communicated. The address of the President, Sir George King, dealt with the history and present position of Indian botany, and his remarks on the unsatisfactory training given in England to officers destined for the Indian Forest Service were received with approval. Mr. Francis Darwin's paper on the geotropic sensitiveness in plants was a most important communication, showing as it did that plants are capable of receiving a stimulus in a sensitive part which is transmitted to another part of the plant and results in a definite movement of that part. From Professor M. Ward and his pupils were received a number of papers on fungi, and Mr. A. C. Seward contributed several papers on fossil botany. Mr. Harold Wager, of Leeds, dealt with the question of sexuality in fungi, and showed that the phenomena are not only comparable to those which occur in higher plants and animals, but that the study of these forms gives an insight into the primary meaning of sexuality. One of the most important papers was that by Sir W. Thiselton-Dyer on the effect of low temperatures on the germination of seeds.

He showed that extreme cold does not interfere with their power of germination.

The Association will meet next year at Bradford, commencing on Wednesday, September 5th, with Sir William Turner as president. The meeting of 1901 will be at Glasgow, and the following meeting will probably be in Ireland.

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*ADDRESS BY THE PRESIDENT OF THE GEOLOGICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.**

AMONG the many questions of great theoretical importance which have engaged the attention of geologists, none has in late years awakened more interest or aroused livelier controversy than that which deals with Time as an element in geological history. The various schools which have successively arisen—Cataclysmal, Uniformitarian, and Evolutionist—have had each its own views as to the duration of their chronology, as well as to the operations of terrestrial energy. But though holding different opinions, they did not make these differences matter of special controversy among themselves. About thirty years ago, however, they were startled by a bold irruption into their camp from the side of physics. They were then called on to reform their ways, which were declared to be flatly opposed to the teachings of natural philosophy. Since that period the discussion then started regarding the age of the Earth and the value of geological time has continued with varying animation. Evidence of the most multifarious kind has been brought forward, and arguments of widely different degrees of validity have been pressed into service both by geologists and paleontologists on one side, and by physicists on the other. For the last year or two there has been a pause in the controversy, though no general agreement has been arrived at in regard to the matters in dispute. The present interval of comparative quietude seems favorable for a dispassionate review of the debate. I propose, therefore, to take, as perhaps a not inappropriate subject on which to address geologists upon a somewhat international occasion like this present meeting of the British Association at Dover, the question of Geological Time. In offering a brief history of the discussion, I gladly avail myself of the opportunity of enforcing one of the lessons which the discussion has impressed upon my own mind, and to point a moral which, as it seems to me, we geologists may take home to ourselves from a consideration of the whole question. There is, I think, a practical outcome which may be made to issue from the controversy in a combination of sympathy and coöperation among geologists all over the world. A lasting service will be rendered to our science if by well-concerted effort we can place geological dynamics and geological chronology on a broader and firmer basis of actual experiment and measurement than has yet been laid.

To understand aright the origin and progress of the dispute regarding the value of time in geological speculation, we must take note of the attitude maintained towards this subject by some of the early fathers of the science. Among these pioneers none has left his mark more deeply graven on the foundations of modern geology than James Hutton. To him, more than to any other writer of his day, do we owe the doctrine of the high antiquity of our globe. No one before him had ever seen so clearly the abundant and impressive proofs of this remote antiquity recorded in the rocks of the earth's crust. In these rocks he traced the operation of the same slow and quiet processes which he observed to be at work at present in gradually transforming the face of the existing

* Dover meeting, September, 1899.